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Spring migration of the Taiga Bean Goose *Anser f. fabalis* along the "Western Flyway" in northern Sweden: numbers in 2003–2008 and timing in comparison with the "Central Flyway" in Finland

Vårflyttning av taigasädgås Anser f. fabalis *längs den "västra flyttvägen" i norra Sverige: rastantal 2003–2008 och tidsmässig kulmination i jämförelse med den "centrala flyttvägen" i Finland*

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Abstract

Daily counts and conservative estimates of turn-over showed that at least 3000 Taiga Bean Geese regularly used the Ume River Delta as the major staging site along the Western Flyway (following the west coast of the Gulf of Bothnia) during spring 2003–2008. Counts across all staging sites yielded 2700–3700 geese in southern Västerbotten and 4000–4800 at all sites in Västerbotten and Norrbotten. We estimate that 5000–6000 geese currently use the Western Flyway. Migration along the Central Flyway (Ostrobothnia, Finland) culminated on average about ten days earlier, meaning that the vast majority of geese using this flyway had left southern Sweden when the Western Flyway was activated. Counts of active migration on 15 April 2007 indicated that geese arriving in the Ume River Delta in late afternoon had passed Alirs öga, Söderhamn, 340 km to the south, five hours earlier. Assuming the same ground speed (68 km h^{-1}) south of Söderhamn, these geese ought to have left either Lake Östen and/or Lake Kvismaren at sunrise, reaching the staging sites in Västerbotten after a 600–700 km non-stop flight.

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Introduction

During spring, three flyways have been recognized for the Taiga Bean Goose *Anser f. fabalis* (depicted in Fig. 1 of Skyllberg et al. 2008). The "Eastern Flyway" is the less well-known (Pessa et al. 2004) and runs south and east of the Baltic Sea from wintering grounds in eastern Germany and Poland to breeding grounds mainly in Russia. The "Central Flyway" runs from Denmark and southern Sweden to western part of Finland after crossing the southern Bothnian Sea and is used by Finnish and west Russian breeders. The "Western Flyway" follows the west coast of the Bothnian Sea and Bothnian Bay, and has been proposed to be used by individuals mainly breeding in northern Norway, Sweden and northwest Finland (Skyllberg et al. 2008). Current estimates (2007) suggest that a maximum of 30,000 Taiga Bean Geese use the Eastern Flyway during spring, 50,000 use the Central Flyway (Skyllberg & Tjernberg 2008) and 5000–6000 use the Western Flyway (Skyllberg et al. 2008).

The Central Flyway is particularly well-known. Over 1000 Taiga Bean Geese were marked on breeding and moulting grounds in Finland during 1982–1994 and 2002–2004, resulting in 6390 observations until 2004 (Pessa et al. 2004). These observations give a clear picture of the Central Flyway. In early spring the geese leave their wintering grounds in mainly SE Denmark and Scania (mild winters they may winter in Småland, and in cold winters also the Netherlands and Germany may host geese using the Central Flyway), pass through southern Sweden to spring staging sites in Västergötland, Östergötland, Närke, Västmanland, Sörmland and Uppland. After 2–4 weeks of stag-

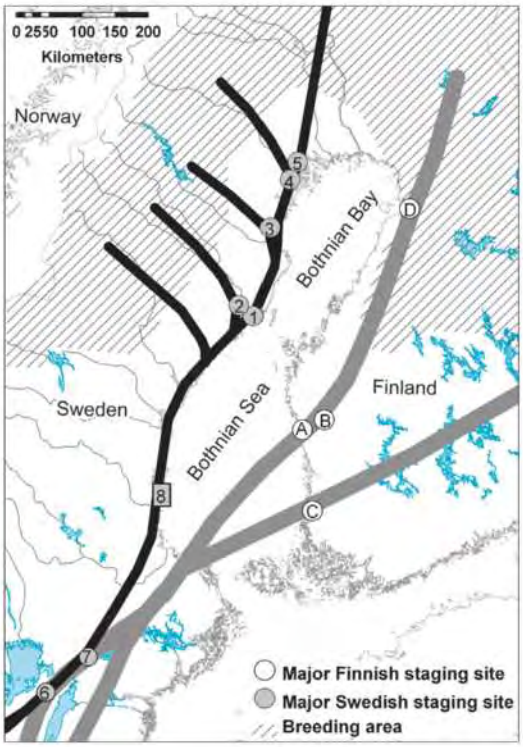

Figure 1. Five major staging sites for the Taiga Bean Goose along the Western Flyway (black line): (1) Ume River Delta, (2) Lake Bråsjön, (3) Lake Ostträsket, (4) Alvik/Ersnäs, and (5) Persöfjärden. Four major staging sites along the Central Flyway (Grey, thick line): A (Kristinestad) and B (Kauhajoki) in southern Ostrobothnia, C Satakunta (Björneborg area) and D Liminga (Uleåborg area) northern Ostrobothnia. Two major staging sites in southern Sweden with a proposed link to the Western Flyway are: (6) Lake Östen, and (7) Lake Kvismaren. The site designated (8) is Alirs Öga (Söderhamn). It should be noted that Taiga Bean Geese taking the Central Flyway also migrate west of Lake Vättern. Thus, staging sites (6) and (7) are used by Taiga Bean Geese using both flyways.

Fem stora rastplatser för taigasädgås utmed västra flyttvägen (svart linje):(1) Umedeltat, (2) Bråsjön, (3) Ostträsket, (4) Alvik/Ersnäs och (5) Persöfjärden. Fyra stora rastplatser utmed centrala flyttvägen (grå tjock linje): (A) Kristinestad och (B) Kauhajoki i södra Österbotten, (C) Satakunta i Björneborgsområdet och (D) Liminga vid Uleåborg i norra Österbotten. Två stora rastplatser i södra Sverige med föreslagen länk till västra flyttvägen: (6) Östen och (7) Kvismaren. Lokal (8) är Alirs öga vid Söderhamn. Taigasädgäss som tar den centrala flyttvägen passerar också väster om Vättern. Lokalerna 6 och 7 används således av gäss som använder båda flyttvägarna.

ing (depending on feeding conditions and weather for migration) they cross the southern part of the Bothnian Sea to staging sites in south-west Finland (Ostrobothnia and Satakunta). When leaving these sites, some cross Finland to the east and some follow the Finnish west-coast to the north and the Uleåborg area (Figure 1). In autumn they take the same way but in southbound direction. It should be noted that until 1990, only 2 of 263 re-sightings of marked birds outside Finland were made along the Western Flyway (Nilsson & Pirkola 1991), and until 2004 not a single re-sighting was reported from the major staging sites in Västerbotten (Pessa et al. 2004). Thus, very few birds caught on breeding and moulting grounds in central and northern Finnish Lapland follow the Western Flyway along the west coast of the Golf of Bothnia in spring.

Details about the Western Flyway (Figure 1) are less well known. Until 2004 only 36 Taiga Been Geese were marked with neck-bands within the breeding range in northern Sweden. These birds were caught at a moulting site in southern Lapland in 1987, and 22 of the marked birds were observed the following two winters in Yare Valley, Norfolk, Great Britain. Some of the birds were seen both in autumn and spring in north-western Jutland, Denmark (Parslow-Otsu 1991). This link between Britain, northern Jutland and breeding grounds in north Sweden is further supported by three ringing recoveries of Taiga Bean Geese in the 1950s (Fransson & Petersson 2001). Two birds ringed in the county of Jämtland were shot in England and northern Jutland and a bird ringed in northern Lapland was shot in northern Jutland. Given that approximately 500 Taiga Bean Geese currently use two sites in Great Britain during winter (Hearn 2004) and that at least 2500 individuals regularly are observed in northern Jutland during autumn, spring and mild winters (Pihl et al. 2006), we estimate that a total of 3000 Taiga Bean Geese migrate from Britain/northern Jutland via southern Sweden to their breeding grounds in northern Scandinavia each spring. Staging sites along the Swedish south-west coast (in the county of Halland and southwest Västergötland) have traditionally been assumed to be used by Scandinavian Taiga Bean Geese (Rosenius 1937). This assumption finds indirect support by the fact that very few Taiga Bean Geese marked in Finland (Pessa et al. 2004) have been re-sighted at the important staging site Veselången–Horred (regularly hosting about 1000 Taiga Bean Geese in autumn and mild winters), as well as at the sites in northern Jutland.

Geese breeding in Finnmark, northern Norway,

also use the Western Flyway. Four out of 7 neck-banded Bean Geese marked at the major spring staging site Valdak in Finnmark during 2003 and 2005 were in 2004–2008 observed at spring staging sites in the Luleå area in Norrbotten, approximately 600 km south of Finnmark (Øien & Aarvak 2007, Aarvak & Øien 2009). Interestingly, none of the marked birds have been sighted at any other staging sites in northern Sweden south of the Luleå area despite active search for neck-bands in 2003–2008. Together with two spring observations at Luleå of two Bean Geese marked on a moulting site in Finnmark 1979 (Nilsson, 1982), this suggests that Bean Geese breeding in Finnmark primarily use staging sites in the Luleå area. This is an indication that Bean Geese having different breeding area may use different spring staging sites in Västerbotten and Norrbotten. Depending on snow conditions, strategies (i.e. to use one or combining several staging sites) may also vary among years.

Skyllberg et al. (2008) gave an overview of major and minor staging sites along the Western Flyway, hypothesized links to possible breeding areas and reported spring staging counts for the period 2002–2006. In this paper, data for the major staging sites are extended through 2008, and we compare the timing of spring migration along the Western and Central Flyways. The year 2002 was not included, because data from several sites were not quantitative that year. Focus is put on the most important staging site along the Western Flyway, the Ume River Delta, where counts were made on a daily basis. Based on a case of observed visual migration that permitted calculation of migration speed, we propose a linkage by direct flight between staging sites in southern and northern Sweden. We also use our data to confirm the current estimate (Skyllberg et al. 2008) of the population of Taiga Bean Geese utilizing the Western Flyway.

Materials and methods

Major staging sites along the Western Flyway in northern Sweden

Five major sites are known: Ume River Delta, Umeå (N63° 47' E20° 14'), Lake Bråsjön, Vännäsby (N63° 54' E19° 49'), Lake Ostträsket, Kåge (N64° 55' E21° 03'), Alvik/Ersnäs-fjärden, Luleå (N65°34' E21°46') and Ängesbyn/Persöfjärden, Luleå (65° 45'N; 22° 07'E). These sites and how the geese were counted are described in detail in Skyllberg et al. (2008). At all sites local ornithologists have contributed to the counting of feeding or roosting geese. At the Ume River Delta counts

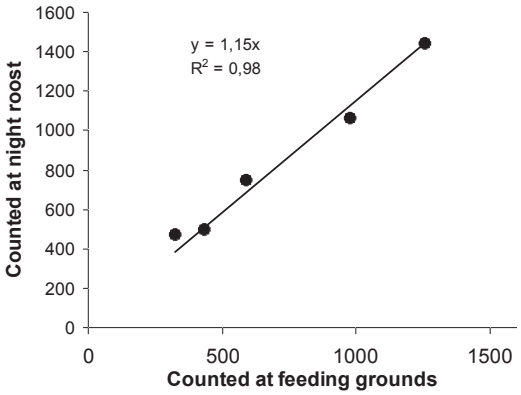

Figure 2. Relationship between counts during daytime at feeding grounds and during the flight to the night roost at five occasions during 2005 (when no geese remained feeding at fields during night). Data from the Ume River Delta.
Förhållandet mellan räkning dagtid på betesplatser och under flygningen till nattplatsen vid fem tillfällen 2005 (då inga gäss stannade kvar på betesplatsen över natten). Data från Umeådeltat.

have been systematic and regular every day, except days with very poor weather conditions. In some years geese were counted both during day-time feeding and during the flight to the night roost. As shown in Figure 2, these two types of counts gave very similar numbers. For a detailed description of the feeding sites and night roost at the Ume River Delta, see Skyllberg et al. (2005). Lake Ostträsket was regularly counted during the culmination of migration in most years, whereas the coverage at all other sites was irregular.

Major staging sites along the Central Flyway in Finland

The Central Flyway takes Taiga Bean Geese from Sweden to Finland after passage of the southern part of the Bothnian Sea (Figure 1). The first major staging sites in western Finland are situated in the counties of Satakunta and southern Ostrobothnia. The most regular and systematic counts of geese are made in Kristinestad and Kauhajoki in southern Ostrobothnia.

Kristinestad (62° 14' N; 21° 28' E)

The three most important staging sites for Taiga Bean Geese are situated along the Lappfjärd River: Lålby (62° 16' N; 21° 28' E), Perus (62° 14' N; 21° 33' E) and Härkmeri (62° 9' N; 21° 26' E). The distance between Lålby and Perus is about five km.

These two sites are connected by the Lappfjärd River. Härkmeri is on the south side of the river delta and about 10 km south of Lålby. All sites are dominated by intensively cultivated arable land, with potato as the main crop. The geese feed on potato fields, as well as on stubble fields after harvest of barley. The night roost is situated in the archipelago of the Bothnian Sea outside the river delta. The reported counts cover all three major sites, as well as fields between major sites. Several local ornithologists have contributed to the counts, mainly in afternoons and early evenings. During weekends efforts have been made to organize counts in a more systematic way. The data in diagrams represent situations, where at least the most important sites have been counted.

Kauhajoki (62° 26′ N; 22° 3′ E)

Kauhajoki is the second most important staging area for Taiga Bean Geese in southern Ostrobothnia. This area is located about 35 kilometers north-east of Kristinestad. This means that some geese may use both areas for staging, especially if spring is cold and migration is suspended for a long time. In Kauhajoki the geese feed mainly on stubble fields and cultivated grasslands. Arable land is located along a small river, which is flooded almost every year, producing very attractive feeding conditions. The geese prefer two sites, which are located about 8 km from each other. The local ornithologists counted geese mainly in the afternoons and early evenings. Even if the counts were not strictly systematic, they were made at least every second day.

Goose days, minimum turnover and maximum length of stay at the Ume River Delta

For 2003–2008, the number of goose days at the Ume River Delta was calculated by summarizing the number of geese (N) counted each day (i) ($\sum N_{day\ (i)}$). In order to get an estimate of goose days at the few days without counts, data were linearly interpolated using the following equation: $N_{day\ (i)} = (N_{day\ (i-1)} + N_{day\ (i+1)})/2$.

A minimum turnover and a minimum number of geese utilizing the site was calculated using eq. (1). Note that only positive numbers (a net arrival of geese) of the difference $[N_{day\ (i+1)} - N_{day\ (i)}]$ are summarized. Negative numbers represent a net decrease in the number of geese. The situation when geese are both arriving and leaving the same day is not taken into account, which makes the calculated number an underestimation of actual numbers of staging geese.

Minimum number of spring staging geese =

$$\sum([N_{day\ (i+1)} - N_{day\ (i)} > 0]) \quad (1)$$

The maximum length of stay (LOS) was calculated by dividing the total number of goose days ($\sum N_{day\ (i)}$) with the minimum number of spring staging geese, calculated by eq. (1).

Count of active migration on 15 April 2007

On 15 April 2007, migrating Taiga Bean Geese were counted between 0830 and 1400 hours (local Swedish time) at the site Alirs öga, Söderhamn (340 km south of Umeå) and at the Ume River Delta between 1400 and 2000 hours. The size of flocks and the time of passage were noted. From the culmination at both observation sites, an average flight speed was calculated which in turn was used to calculate the total flight distance and estimate the origin of the geese (assuming a take off in early morning).

Results

Spring staging and calculation of turn-over at the Ume River Delta

The date for maximum day count and maximum mean length of stay in the Ume River Delta is given in Table 1. The length and pattern of staging varied among years (Figure 3), which can be explained by a combination of weather conditions at staging sites in southern Sweden as well as along the Western Flyway, in particular snow cover at the feeding grounds. Details for spring conditions during 2003–2006 are given in Skyllberg et al. (2008). In 2007 the spring was record early, and 32 Taiga Bean Geese arrived already on 26 March during a period with very warm weather. Then the weather was colder again for two weeks, and not until 13 April the major migration period was initiated. This resulted in an extended spring staging period, as reflected by a maximum LOS of 10.3 days (as compared to 5.8–8.3 days for 2003–2006, Table 1) and a total staging period of almost a month (Figure 3). Also spring 2008 was early, especially in southern Sweden, but severe snow conditions further north postponed the major arrival till 16 April. In the Ume River Delta food was available, but inland and further north the snow cover was deep, keeping the geese in southern Västerbotten for longer that usual. The period with >100 staging Taiga Bean Geese was more than 3 weeks and the maximum LOS 9.3 days.

Table 1. Maximum day counts and conservative turnover calculations of Taiga Bean Geese Anser f. fabalis staging at the Ume River Delta during the period 2003–2008.
Högsta dagsantal och försiktig beräkning av omsättningen av taigasädgäss som rastade i Umedeltat åren 2003–2008.

	2003	2004	2005	2006	2007	2008
Maximum day count *Max. dagsantal*	1 270	1 710	1 600	2 320	1 530	2 380
Date *Datum*	26.4	21.4	22.4	24.4	18.4	24.4
Total number of goose days *Totala antalet gåsdagar*	14 402	18 614	18 508	18 446	18 566	25 555
Calculated minimum arrival of new geese* *Beräknat minsta antal nyanlända gäss**	2 500	2 540	2 240	2 910	1 660	2 740
Maximum LOS (days) *Högsta antal rastdagar (LOS)*	5.8	7.3	8.3	6.4	10.3	9.3
Number of geese assuming LOS×0.8 *Antal gäss om LOS×0,8*	3 130	3 210	2 800	3 620	2 260	3 430

*Conservative estimate determined by equation (1). *Försiktig beräkning enligt ekvation (1).*

Our very conservative estimate of the turnover of staging geese suggests that between 1660 and 2910 Taiga Bean Geese were utilizing the Ume River Delta the period 2003–2008 (Table 1). In 2003, the turnover calculation yields 2500 birds as compared with the modest maximum day count of 1270 individuals on 26 April. Thus, turnover was twice the maximum day count. In contrast, a steady build-up of geese to a marked maximum, followed by a successive departure in spring 2007 resulted in a small difference between total and maximum day count (Table 1). The weighted, mean maximum LOS was calculated to be 7.8 days for the period 2003–2008. Because only net changes of birds are considered, this calculation gives a maximum estimate of the LOS and an underestimation of the total number of geese using the site. If we assume the error of not accounting for simultaneous arrival and departure is 20%, we can calculate a corrected number of geese by dividing the total number of goose days with LOS×0.8. The calculation results in a range of 2260–3620 and an average of 3075 Taiga Bean Geese utilizing the Ume River Delta as a spring staging site during the study period.

Timing and numbers of Taiga Bean Geese using the two major sites in southern Västerbotten

Lake Brånsjön, which is situated 35 km inland along the Ume River valley (Figure 1), and the Ume River Delta are the two by far most important spring staging sites in southern Västerbotten. Normally, the feeding grounds are getting free from snow at least one week later at Lake Brånsjön than along the coast. Because of this, the first wave of Taiga Bean Geese always arrives at the Ume River Delta. This pattern was particularly obvious in 2007 and 2008, when 100–200 Taiga Bean Geese were staying for more than 10 days at the Ume River Delta before the first flock was sighted at Lake Brånsjön. If the date of culmination is compared, the difference between the two sites is less pronounced (Figure 3). The culmination occurred at approximately the same time at both sites in the years of 2003 and 2007, and there was a tendency for a slightly later (2–5 days) peak at Lake Brånsjön in 2004, 2005 and 2008, even if the relatively small number of days with counts at the latter site limits the possibilities for a statistical analysis. In 2006 the spring was by far the latest during the study period, and when the geese finally arrived to the Ume River Delta the snow depth was 20–50 cm at the feeding sites at Lake Brånsjön. Such a late spring inhibits the geese from using Brånsjön as a staging site until the end of April, and the total number of individuals using the site may not be more than 500, as compared to maximum day counts of 1500 during years with good feeding conditions.

In Table 2 the maximum of single day count at the Ume River Delta and Lake Brånsjön is reported for 2005–2008. Despite some variation among years in numbers occurring at each site, it is interesting to note that the sum of geese using both sites (including approximately 200–400 geese staging at some minor and less regular sites in southern Västerbotten) was in the range 2700–3700 every year. Even if the total number was lowest in 2006, the very low numbers at Lake Brånsjön was compensated for by unusually high numbers at the Ume River Delta. This suggests that during unfavour-

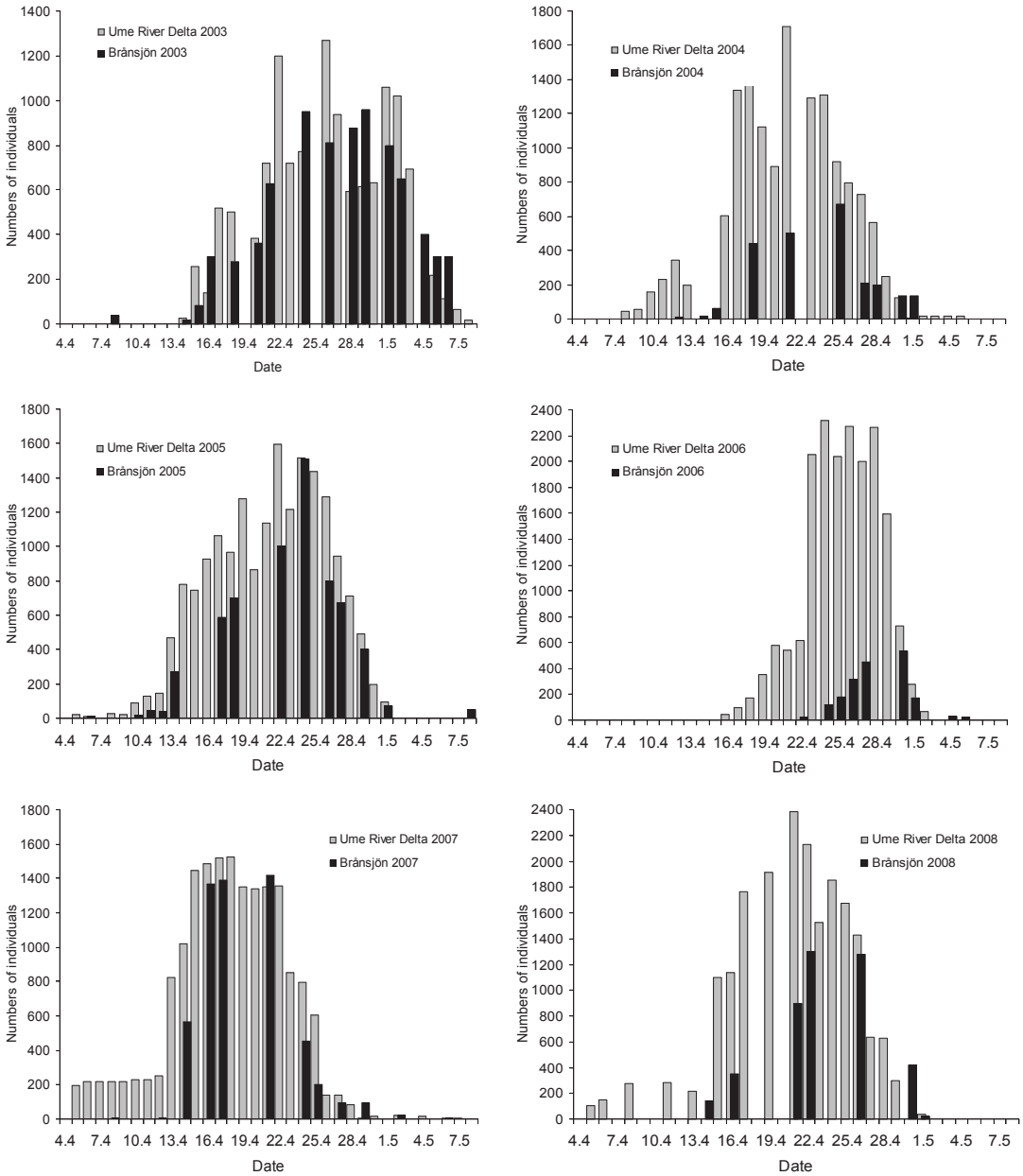

Figure 3. Staging numbers of Taiga Bean Geese Anser f. fabalis at the Ume River Delta and at Lake Bråsjön 2003–2008. Note that in 2007 a total of 32–170 individuals were staging at the Ume River Delta during the period 26 March – 3 April, but for reasons of comparison, the x-axis is the same for all plots. Note the variation in maximum numbers on the y-axis.
Rastande gäss vid Umedeltat och Bråsjön 2003–2008. År 2007 fanns 32–170 gäss i Umedelta 26 mars till 3 april, men för jämförelsens skull har x-axeln samma längd i alla diagram.

Table 2. Maximum single day counts and dates of the counts for individual sites, for all sites in southern Västerbotten and for all sites in Västerbotten and Norrbotten during the period 2005–2008.
Högsta årliga dagsantal samt datum för detta på enskilda lokaler, alla lokaler i södra Västerbotten och alla lokaler i Västerbotten och Norrbotten.

Year *År*	Ume River Delta		Lake Brånsjön		Southern Västerbotten		Lake Ostträsket		Västerbotten & Norrbotten	
2008	2380	24.4	1300	22.4	3700	21.4	960	27.4	4800	22–24.4
2007	1530	18.4	1420	21.4	3000	17.4	590	24.4	4300	22.4
2006	2320	24.4	534	30.4	2700	24.4	740	2.5	4000	27–28.4
2005	1600	22.4	1510	24.4	3000	24.4	570	24.4	4300	24.4

able spring conditions at Lake Brånsjön, Taiga Bean Geese normally using this site may switch to the Ume River Delta. Furthermore, during the very late spring of 2006 the Taiga Bean Geese obviously were in a hurry to reach their breeding grounds, resulting in only 22,000 goose days in southern Västerbotten, as compared to 33,500 and 32,000 for the years 2005 and 2007, respectively. In 2008 as many as 39,000 goose days were noted. The record early spring in southern Sweden resulted in a mass arrival in the Ume River Delta during the period 15–22 April. Because the snow was still covering feeding grounds at Lake Ostträsket and sites in Norrbotten, the number of Taiga Bean Geese staying in southern Västerbotten remained high until the end of April.

Timing of migration along Western and Central Flyways

In Figure 4 the number of Taiga Bean Geese staging in the southern Ostrobothnia area (Kristinestad and Kauhajoki) is compared to numbers staging in southern Västerbotten (the sum of Ume River Delta and Lake Brånsjön). Note that the culmination occurred 8–15 days earlier at the Finnish side of the Bothnian Sea. This principal difference in timing is independent of the annual weather conditions, even if late and cold weather conditions during the spring in 2006 compressed the migration period both along the Central and Western Flyways making the difference in timing smaller. As a consequence, it can be concluded that the vast majority of Taiga Bean Geese taking the Central Flyway have left the staging sites in south-central Sweden when the Western Flyway is activated.

It should be noted, that a similar number of Taiga Bean Geese as reported for southern Ostrobothnia is using the major staging sites in Satakunta (Pori), designated with letter C in Figure 1. At Satakunta the culmination of the migration in some years may be up to one week earlier than at the sites in Southern Ostrobothia (Pessa et al. 2004), extending the difference in timing along the Western and Central Flyways even more.

Direct migration from southern Sweden to staging sites in southern Västerbotten 2007

The period 12–16 April was the most important period of influx of Taiga Bean Geese from the south in spring 2007, both at the Ume River Delta and at Lake Brånsjön. At Lake Brånsjön only 5 geese were counted on 12 April, and then the number of geese increased from 565 (14 April) to 1370 (16 April). The number of geese remained close to 1400 birds until the maximum count of 1420 (21 April). At the Ume River Delta the number of geese increased from 250 (12 April), to 822 (13 April), 1020 (14 April) and 1443 (15 April). A total of 1400–1500 geese remained for another week until they began to depart. This means that the active migration census conducted on 15 April, as illustrated in Figure 5, reflects the period when most Taiga Bean Geese arrived from the south to both the Ume River Delta and to Lake Brånsjön.

On 15 April, a total of 835 Taiga Bean Geese was observed passing at Alirs öga, Söderhamn (Figure 1) during the observation period 0800–1400 hours. The first flock passed at 1000 hours and the last flock at 1250 hours. Before and after these flocks no Taiga Bean Geese were observed. At the Ume River Delta a total of 471 Taiga Bean Geese were observed to arrive from the south between 1400 and 2000 hours. No single flock was observed to pass the Ume River Delta and continue northwards. The number of arrivals should be compared with an increase in staging numbers from 1020 (14 April), as observed during day count, to 1443 (15 April) as counted during flight to the night roost. Thus, the increase in numbers of staging Taiga Bean Geese was in fair correspondence with the observed

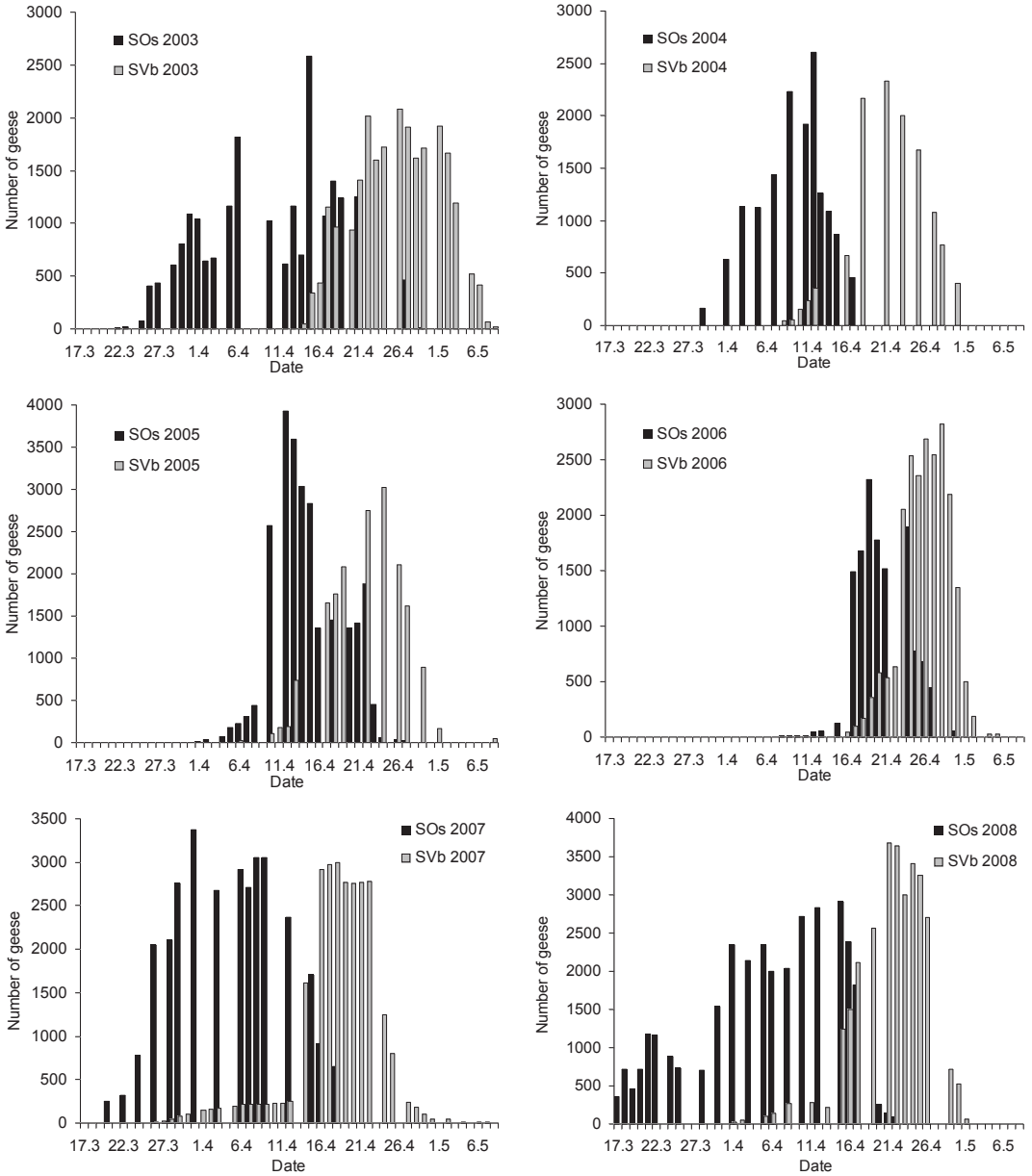

Figure 4. Staging of Taiga Bean Geese Anser f. fabalis in southern Ostrobothnia (SOs: the sum of Kristinestad and Kauhajoki) and southern Västerbotten (SVb: the sum of Ume River Delta and Lake Bråsjön). For reasons of comparison, the x-axis is the same for all plots.

Rastande taigasädgäss i södra Österbotten (SOs: summan för Kristinestad och Kauhajoki) och södra Västerbotten (SVb: summan för Umedeltat och Bråsjön). För jämförbarhetens skull är x-axeln densamma i alla diagrammen.

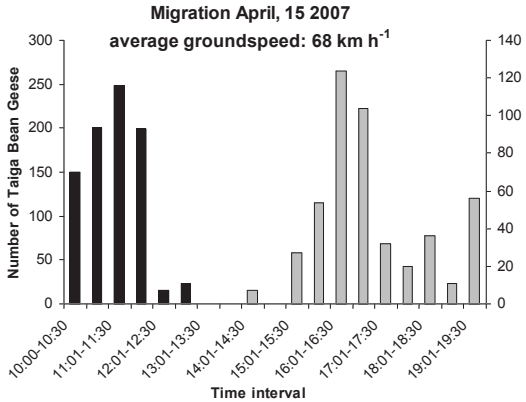

Figure 5. Numbers of Taiga Bean Geese Anser f. fabalis observed in active migration to the north at Alirs öga, Söderhamn (black bars, and left y-axis) and observed arrival from the south at the Ume River Delta (grey bars, and right y-axis) on 15 April 2007.
Antal taigasädgäss som sträckte norrut vid Alirs öga, Söderhamn (svarta staplar, vänstra y-axeln) och antal som sågs anlända från söder till Umedeltat (grå staplar, högra y-axeln) den 15 april 2007.

number of arriving geese. It should be noted that also earlier experiences are that Taiga Bean Geese normally arrive in late afternoon and evening to the Ume River Delta in spring. The discrepancy of approximately 435 birds (835 observed at Söderhamn and 400 at the Ume River Delta during a corresponding 2 h and 50 min period) can be explained by an arrival at Lake Brånsjön. This was verified on the same day by observations from the water tower in the municipality Hörnefors (30 km south of Umeå), where geese heading for Lake Brånsjön were observed to leave the coast (Stefan Delin, pers. comm.). Unfortunately no counts were made at Lake Brånsjön in the afternoon of 15 April, but a similar absolute increase of staging Taiga Bean Geese at Lake Brånsjön and the Ume River Delta was observed during the period of 12–16 April.

Estimate of total number of Taiga Bean Geese using the Western Flyway

In order to estimate the total number of Taiga Bean Geese using the Western Flyway, which is hypothesized to be an estimate of the Scandinavian breeding population (including breeding grounds in NW Finland; Skyllberg et al. 2008), data from staging sites in northern Västerbotten and Norrbotten are needed. At Lake Ostträsket almost daily counts were available, but for the sites in Norrbotten only irregular counts were undertaken. In Figure 6 numbers of staging Taiga Bean Geese and the timing of migration can be compared for the Ume River Delta, Lake Ostträsket and the major staging site in Norrbotten (Alvik/Ersnäs). During the culmination of migration (which is known from daily visits by many ornithologists), counts are considered to be fair at the Norrbotten sites and therefore the maximum day count at all sites in Västerbotten and Norrbotten during culmination is reported in Table 2.

Discussion

Connectivity among staging sites in southern and northern Sweden

The link between spring staging sites in southern and northern Sweden is still an unresolved issue, discussed a long time (e.g. Rosenius 1937). The finding that the culmination of migration along the Central and Western flyways are well separated in time (Figure 4), suggests that the major candidate sites in southern Sweden are to be searched among those hosting larger flocks of Taiga Bean Geese after culmination of migration along the Central Flyway. Considering the traditional focus on staging sites west of Lake Vättern as the ones most likely utilized by Taiga Bean Geese breeding in Scandinavia, Nilsson (1984) pointed at a similar pattern of major arrival at sites in southern Västerbotten as the pattern of major departure from Lake Kvismaren (cf. Figure 1) when analysing data collected in the late 1970s and early 1980s. The study of visual migration on 15 April 2007 (this study) may give some support for this assumption. There were several observations of 100–600 Taiga Bean Geese migrating in a northeast direction over Västmanland that particular day (as reported in the electronic database for bird observations in Sweden http://www.artportalen.se/birds/). Thus, it is suggested that the active migration observed at Söderhamn and the Ume River Delta was originating from departure at sites in western Sweden, likely Lake Kvismaren and/or Lake Östen. Both these sites had at least 600–2000 Taiga Bean Geese remaining in mid April 2007.

Given the distance between Söderhamn and the Ume River Delta (350 km), an average ground speed of 68 km h^{-1} can be calculated for the peak migration period (1000–1230 hrs at Söderhamn and 1500–1730 hours at the Ume River delta). If we assume the same speed south of Söderhamn (the weather was similar along the proposed mi-

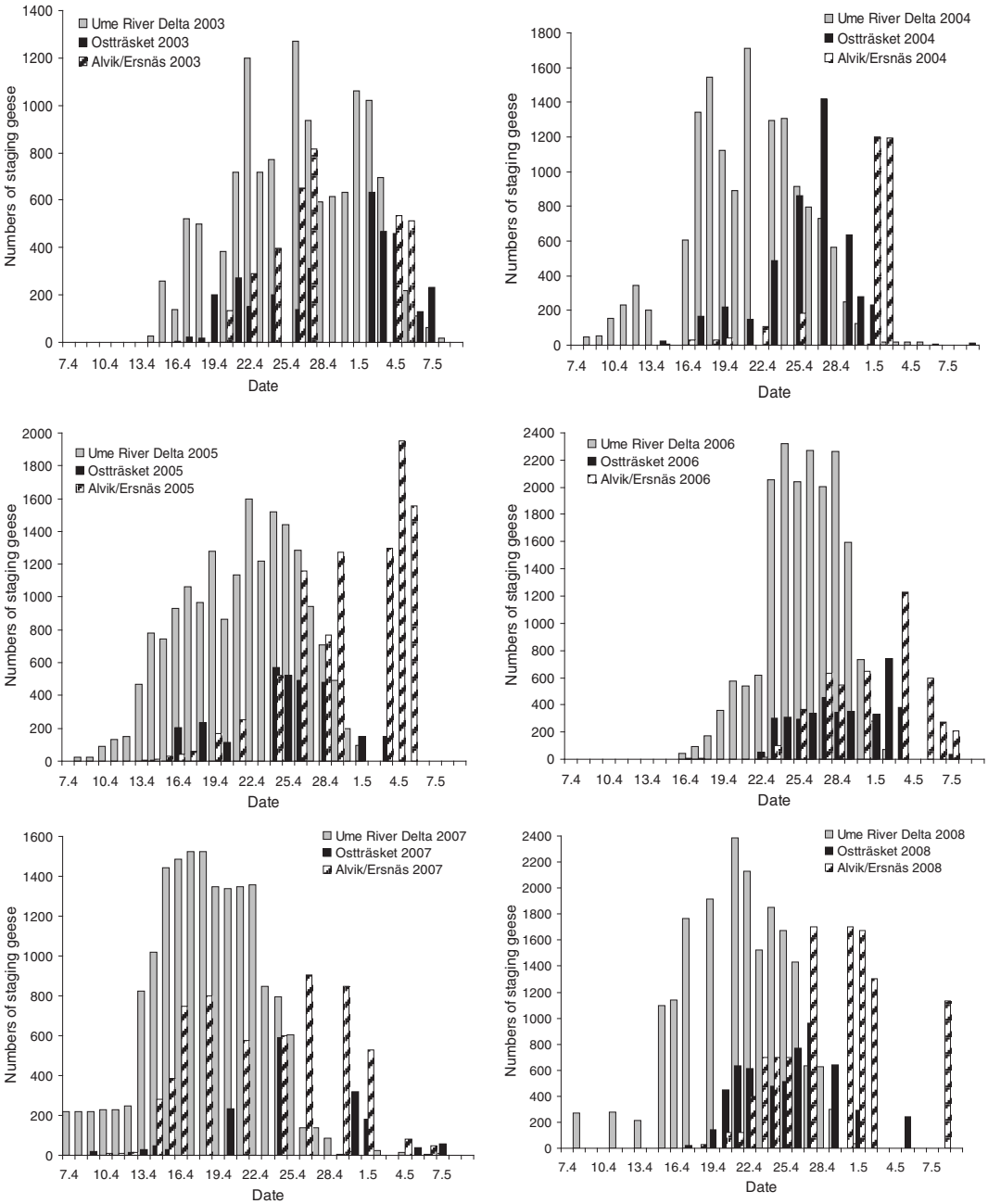

Figure 6. Spring staging of Taiga Bean Geese Anser f. fabalis at Ume River Delta, Lake Oströsket and at Alvik/Ersnäs 2003–2008.

Taigasädgåsens vårrastning i Umedeltat, Oströsket och Alvik/Ersnäs 2003–2008.

gration route with moderate tail-winds from southwest and scattered high clouds), we can speculate about possible origin of the geese. The staging site Lake Kvismaren is situated 280 km and Lake Östen 380 km southwest of Söderhamn (Figure 1). If the geese left Lake Östen, the estimated departure would have been 0420–0650 hours for the geese observed at Söderhamn. If the origin was Lake Kvismaren the estimated departure would have been between 0550–0820 hours. Given that departure under beneficial weather conditions normally takes place when the geese leave the night roost in the early morning light, the timing at Lake Östen better fits what we would expect. It should be noted that Lake Kvismaren and Lake Östen are the two sites which in most years have shown numbers of Taiga Bean Geese late in spring large enough to match the numbers of geese utilizing the Western Flyway (Nilsson 1984, Skyllberg et al. 2003).

Connectivity among sites in northern Sweden along the Western Flyway

An obvious question arising is whether the major staging sites in Västerbotten and Norrbotten are used by partly the same birds, or if the majority of the birds only use one of the sites. Another question is whether individuals may chose different sites and strategies different years, depending on weather conditions. It was observed (Table 1) that the geese use the southernmost site, the Ume River Delta, during a longer time in years with periods of extensive snow cover further inland and to the north. Such late years, when feeding conditions may be difficult, and many geese compete for the food supply (together with whooper swans), a combination with staging at sites further north may be energetically favourable. Early, warm spring conditions, on the other hand, it may be more favourable to prioritize an early arrival at the breeding grounds, and only use one major staging site. Under good feeding conditions another stop may not be energetically justified given the relatively short distances among most of the staging sites in Västerbotten and Norrbotten. The definite answer of these questions can only be addressed by focussed studies, involving individually marked birds. At this point, there are no official reports available from such ongoing studies (Nilsson, pers. comm.).

It should be noted that there are no visual observations of movements during any time of the day indicating that there is a daily exchange of individuals or groups of Taiga Bean Geese between the Ume River Delta and Lake Brånsjön. Based on this information and on the major NW direction of migration upon departure from Lake Brånsjön, Skyllberg et al. (2008) hypothesized that Taiga Bean Geese using Lake Brånsjön during spring with favourable feeding conditions have their breeding areas situated further south than Taiga Bean Geese staging in the Ume River Delta. Also this hypothesis needs to be tested by observations of individually marked birds.

The geese departing from the Ume River Delta in late April take a direction mainly towards the north, along the coast. The geese pass, and may stop, at the major staging sites Lake Ostträsket, 150 km north of Umeå, at Alvik/Ersnäs, 220 km north of Umeå, and at Persöfjärden, 260 km north of Umeå. With only few data from neck-banded individuals, evidence for a connection among the sites along the west coast of the Bothnian Bay relies mainly on timing of spring staging and visual observations of active migration. A comparison of the timing of net departure from the Ume River Delta and the net arrival at Lake Ostträsket and at Alvik/Ersnäs (Figure 6) shows a good correspondence in some years (2004, 2005 and 2008). In other years a majority of the geese has already reached the northern sites before the major departure from the Ume River Delta (2003, 2006 and 2007). Thus, during the latter years, the timing of migration may suggest that only a smaller number of Taiga Bean Geese staging at the sites in southern Västerbotten have utilized also the northern sites. Furthermore, observation of visual migration late in the migration period (early May), suggest that a "final" wave of Taiga Bean Geese may pass the Ume River Delta (without stopping) on a northern course, probably with destination in the Luleå area (Skyllberg et al. 2008). It is not unreasonable that a majority of these late arriving geese are breeding in the northernmost part of Scandinavia, including some individuals of the Tundra Bean Goose subspecies *Anser f. rossicus* (se discussion below).

The connectivity among the sites along the Finnish west coast is much better resolved because of the studies of 1000 neck-banded Taiga Bean Geese (Pessa et al. 2004). These studies show that very few individuals use sites both in Satakunta and southern Ostrobothnia (cf. Figure 3) the same spring. The distance between these two major staging areas is approximately 100–150 km. Most of the geese staging in southern Ostrobothnia, as well as part of the geese staging in Satakunta, migrate 400–500 km further north to the Uleåborg area in northern Ostrobothnia (designated D in Figure 1). This is the area of Finland with the highest numbers

of spring staging Taiga Bean Geese (maximum day counts of 10,000).

Population estimate of the Western Flyway – the Scandinavian breeding population

Based on counts at spring staging sites in southern Sweden 2007, Skyllberg & Tjernberg (2008) estimated that the sum of Taiga Bean Geese using the Western and Central Flyways was 56,000. Skyllberg et al. (2008) suggested that 5000–6000 Taiga Bean Geese used the Western Flyway, based on counts at staging sites in northern Sweden 2002–2006. In this study additional counts during 2007 and 2008 verify this estimate. Given that the maximum count a single day at all sites was 4800 in 2008 (Table 2), and the uncertainty concerning turn-over, it may even be reasonable to extend the upper limit to 6500 individuals. On the other hand, recent genetic investigations (Ruokonen et al. 2008) and counts during moulting (Øien & Aarvak 2008) may suggest that on the order of 500–1000 Bean Geese moulting in Finnmark are of the Tundra Bean Goose subspecies. Given that some of these birds have characters not typical for either the Taiga or the Tundra Bean Goose subspecies and that neck-banded birds from Finnmark regularly are observed in the Luleå area, it may be suggested that a substantial number of Bean Geese counted in Alvik/Ersnäs and Persöfjärden could be of the subspecies *rossicus*. At this point we consider the possible contribution from rossicus birds at the two northern sites to roughly balance the increase in the total numbers obtained in 2007–2008 (as compared to the period 2002–2006). Thus, we feel that 5000–6000 is a reasonable estimate of the number of Taiga Bean Geese utilizing the Western Flyway and likely breeding in Norway, northern Sweden and NW Finnish Lapland.

The staging sites in southern Västerbotten annually host on the order of 50 Pink-footed Geese *Anser brachyrynchus* and the same number of Tundra Bean Geese, which likely have deviated from their major flyways to Svalbard and the Kola Peninsula (possibly including east Finnmark), respectively. Therefore we could expect that a similar magnitude of Taiga Bean Geese heading for breeding grounds east of Scandinavia may, for some reason, have ended up at more western route a single spring. Thus, our Western Flyway estimate includes also those individuals. However, based on the fact that only a handful of the 1000 neck-banded Finnish birds have been observed along the Western Flyway, we would expect that the number of individuals deviating from their major flyways is quite small. It should also be considered that a certain gene-flow (by pair-formation between individuals with parents from different flyways) is a rule among Flyway Populations of the same sub-species. This is facilitated by overlapping wintering grounds (although knowledge about this is very limited) and overlapping spring staging sites in parts of southern Sweden.

Should actions be taken to improve the conservations status of the Taiga Bean Goose?

The indicated decline of the world population of the Taiga Bean Goose, from 90,000–110,000 in the 1990s (Nilsson et al. 1999) to the present 80,000–85,000 (Skyllberg & Tjernberg 2008), may qualify the sub-species as a "Column A population" according to the African-European Migratory Waterbirds Agreement (AEWA). This means that all countries hosting major wintering, spring and autumn staging and breeding sites have a responsibility to maintain and improve the status of the Taiga Bean Goose. Furthermore, an International Action Plan to improve the status may be needed. Currently AEWA only recognizes one single world population of the Taiga Bean Goose, comprising its entire breeding range from Scandinavia to east of the Urals. If the subspecies could be shown to consist of two or more separate populations (by genetics or flyway separation), their small sizes and possible decline the last decades would classify them as Column A populations. This would also mean that Norway, Sweden and Finland have a special responsibility for the small Scandinavian (including breeding grounds in NW Finland), Western Flyway population. This responsibility includes gathering of information on the most important wintering, migration (staging) and breeding sites and ensure their sustainable use by Taiga Bean Geese using the Western Flyway.

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References

Aarvak, T. & Øien, I. J. 2009. *Monitoring of Bean Goose in Finnmark County, Norway – results from 2008.* Norsk Ornitologisk Förening. NOF rapport 2-2009.

Fransson, T., & Pettersson, J. 2001. *Svensk ringmärkningsatlas.* Vol. 1. Stockholm (In Swedish).

Hearn, R. 2004. *Bean goose* Anser fabalis *in Britain and Ireland 1960/61–1999/2000.* Waterbird Review series, The Wildfowl & Wetlands Trust / Joint Nature Conservation Committee, Slimbridge.

Nilsson, L. 1984. Migrations of Fennoscandian Bean Geese *Anser fabalis*. *Swedish Wildlife Research* 13: 83–106.

Nilsson, L., & Persson, H. 1984. Non-breeding distribution numbers and ecology of Bean Goose *Anser fabalis* in Sweden. *Swedish Wildlife Research* 13: 107–170.

Nilsson, L., & Pirkola, M.K. 1991. Migration pattern of Finnish Bean Geese *Anser fabalis*. *Ornis Svecica* 1: 81–92.

Nilsson, L., van den Bergh, L., & Madsen, J. 1999. Taiga Bean Goose (Anser fabalis fabalis). Pp. 20–36 in *Goose populations of the Western Paleractic. A review of status and distribution* (Madsen, J., Cracknell, G.S., & Fox, A.D., eds.) Wetlands International Publications No. 48, 20–36.

Øien, I. J. &Aarvak, T. 2007. *Resultater fra overvåkning av dverggås og saedgås i Norge i 2007.* Norsk Ornitologisk Forening. NOF rapport 6-2007. (In Norwegian)

Parslow-Otsu, M. 1991. Bean Geese in the Yare Valley, Norfolk. *British Birds* 84: 161–170.

Pessa, J., Väyrynen, E. & Timonen, S. 2004. Metsähanhitutkimuksen ja –seurannan tuloksia kolmen vuosikymmen ajalta. English Summary: The results of three decades of research and monitoring studies of the Finnish Bean Goose population. *Linnut-Vuosikirja* 28–33.

Pihl, S., Clausen, P., Laursen, C., Madsen, J., & Bregnballe, T. 2006. *Conservation status of bird species in Denmark covered by the EU Wild Birds Directive.* NERI Technical report No. 570. National Environmental Institute Denmark.

Rosenius, P. 1937. *Sveriges fåglar och fågelbon.* Fjärde bandet. C.W.K. Gleerups förlag, Lund. (In Swedish)

Ruokonen, M., Litvin, K. & Aarvak, T. 2008. Taxonomy of the bean goose – pink-footed goose. *Molecular Phylogenetics and Evolution* 48: 554–562.

Skyllberg, U., Hansson, P., Bernhardtson, P. & Naudot, E. 2003. Taigasädgåsen (Anser f. fabalis) i Umedeltat och Norra Norrlands kustland – rastantal under våren 2002–2003 i perspektiv till uppgifter från 70-, 80-, och 90-talen. *Fåglar i Västerbotten* 28: 54–64.

Skyllberg, U., Hansson, P., Bernhardtson, P. & Naudot, E. 2005. The roost-feeding area complex of Taiga Bean Goose *Anser f. fabalis* in the Ume River Delta Plains, Sweden – foraging patterns in comparison with Greylag Goose Anser anser, Whooper swan *Cygnus Cygnus* and Eurasian Crane *Grus grus*. *Ornis Svecica* 15: 73–88.

Skyllberg, U., Hansson, P., Andersson, Ö., Bernhardtson, P., Gustafsson, R., Laisfeldt, M., Naudot, E. & Nordlund, M. 2008. Spring staging, flyways and population estimate of the northern Scandinavian Taiga Bean Goose (*Anser f. fabalis*) in 2002–2006. *Die Vogelwelt* 129: 253–262.

Skyllberg, U. & Tjernberg, M. 2008. Spring staging of Taiga Bean Goose *Anser f. fabalis* in southern Sweden 2007 – estimate of the size of populations using the western and central flyway. *Ornis Svecica* 18: 45–51.

Sammanfattning

Under vårflyttningen rastar och sträcker taigasädgåsen *Anser f. fabalis* i huvudsak längs tre flyttvägar. Längs den ”östra flyttvägen” tar sig gäss från vinterkvarter i östra Tyskland och Polen via Baltikum till häckområden i Ryssland. Den ”centrala flyttvägen”, som nyttjas av gäss häckande i Finland och västra Ryssland, löper från vinterkvarter i södra Sverige och Danmark via södra Bottenhavet till rastplatser i västra Finland. Den ”västra flyttvägen” löper från södra Sverige längs västra sidan av Bottniska viken (Norrlandskusten), och nyttas av gäss med häckplatser i norra Norge, Sverige och nordvästra Finland. Räkningar på övervintringslokaler och under vårflyttning på senare år pekar på en världspopulation om ca 80.000–85.000 taigasädgäss, av vilka maximalt 25.000–30.000 sträcker längs den östra, ca 50.000 längs den centrala (Skyllberg & Tjernberg 2008) och 5000–6000 längs den västra flyttvägen (Skyllberg m. fl., 2008).

Omfattande färgringmärkning i Finland 1982–1994 och 2002–2004 har gett stor kunskap om taigasädgäss som utnyttjar den centrala flyttvägen (Pessa 2004). Det faktum att t.o.m. 2004 endast 2 av 6390 (0,03%) avläsningar gjordes längs Norrlandskusten visar hur väl avgränsad den centrala flyttvägen är från den västra. Färgringmärkning av individer som med säkerhet nyttjar den västra flyttvägen inskränker sig till 36 ruggande taigasädgäss från Åsele lappmark (1987). Av dessa återsågs hela 22 individer på övervintringsområdet i sydöstra England (Parslow-Outsu 1991). Flera av de märkta gässen sågs även på lokaler på Norra Jylland, Danmark. Sammantaget med ytterligare information från ringmärkning framträder dock bilden a v den västra flyttvägen som nyttjas av taigasädgäss häckande i norra Skandinavien (Norge, Sverige och nordvästra Finska Lappland) och övervintrande i Storbritannien (max 500), Norra Jylland (max 3000) samt ca 2500 i södra Sverige (t.ex. i Viskadalen, Halland).

I detta arbete redovisas räkningar av vårrastande

taigasädgäss på de huvudsakliga rastlokalerna i Väster- och Norrbotten (med fokus på den viktigaste rastlokalen: Natura 2000-området Umeälvens delta och slätter) under perioden 2003–2008, vilka ligger till grund för beräkning av antalet individer som nyttjar den västra flyttvägen. Den tidsmässiga kulminationen jämförs med vårrastningen längs den centrala flyttvägen i västra Finland. Dessutom redovisas data för aktivt sträck till Umedeltat, som ger grund för en beräkning av möjlig uppbrottsplats i södra Sverige.

Material och metoder

Rastande taigasädgäss räknades vårarna 2003–2008 på de fem viktigaste rastplatserna längs den västra flyttvägen: Umeälvens delta (Umeå), Brånsjön (Vännäsby), Ostträsket (Kåge), Alvik/Ersnäsfjärden samt Ängesbyn/Persöfjärden (båda Luleå). Dessa lokalers belägenhet längs Norrlandskusten visas i Figur 1. Med undantag för dagar med dåligt väder, räknades gässen i Umeälvens delta dagligen på födosöksfälten. Vissa år räknades gässen även under inflog till nattplatsen. Räkningar på födosöksfält och under infloget visade god överensstämmelse (Figur 2). Av övriga rastplatser hade Ostträsket den mest regelbundna täckningen, med dagliga, heltäckande räkningar under rastkulminationen de flesta av åren. Från övriga lokaler finns dagliga, men ej heltäckande räkningar utförda av lokala ornitologer. Med dessa som grund utfördes systematiska räkningar vid Brånsjön och Alvik/Ersnäs då en förändring av antalet rastare indikerats. Från Persöfjärden, som är mer oregelbundet utnyttjad som rastlokal (beroende på snöavsmältningen) utnyttjas endast data (för skattning av totala antalet taigasädgäss i Väster- och Norrbotten) under rastkulminationen enstaka år.

I västra Finland räknades taigasädgäss 2003–2008 vid rastlokaler i Kristinestad och Kauhajoki i södra Österbotten (Figur 1). Tillsammans med lokaler vid Björneborg är dessa de viktigaste vårrastplatserna för taigasädgäss längs den centrala flyttvägen i sydvästra Finland. Räkningarna utfördes av lokala ornitologer, med en tyngdpunkt under helger. Data från dessa räkningar används för att jämföra den tidsmässiga kulminationen av sträcket längs den västra och centrala flyttvägen.

Aktivt sträck av taigasädgäss räknades vid Alirs Öga (Söderhamn) och vid Umeälvens delta den 15 april 2007. Data från sträcket användes för att beräkna flyghastigheten samt för att beräkna varifrån gässen sannolikt startade i gryningen.

Resultat och diskussion

För den viktigaste rastlokalen i norra Sverige, Umeälvens delta, redovisas i Tabell 1 dagsmaximum, maximal medeluppehållstid, antalet gåsdagar samt en beräkning av totala antalet rastande taigasädgäss under vårarna 2003–2008. Genom att summera nettoökningen av antalet rastande individer från en dag till en annan gjordes en konservativ beräkning av totala antalet taigasädgäss som rastade i Umeälvens delta med hjälp av ekvation (1). Enligt denna beräkning rastade mellan 1660 och 2910 taigasädgäss i Umeälvens delta under studieperioden. Om det totala antalet gåsdagar divideras med det beräknade totalantalet rastande gäss erhålls ett mått på den maximala medeluppehållstiden (LOS = length of stay). Beroende på väderomständigheter varierade LOS från 5,8 dagar våren 2003 till 10,3 dagar våren 2007 och 9,3 dagar våren 2008. För en beskrivning av väderomständigheter för perioden 2003–2006 hänvisas till Skyllberg m.fl. (2008). Vårarna 2007 och 2008 var båda mycket tidiga, med värme och snöfria förhållanden redan i mitten av mars, men utdragna på grund av en två veckor lång köldperiod i början av april. Djup snö en bit in från Västerbottens kustland medförde att taigasädgässen stannade i Umeälvens delta i större antal och under en längre period under 2008 jämfört med andra år under studieperioden.

Notera att beräkningen av totalantalet rastande gäss (ekvation 1) och LOS inte tar hänsyn till att gäss både kan anlända och flytta vidare samma dag (vilket snarare är regel än undantag i mitten av rastperioden eftersom gässen väljer att flytta under särskilda väderbetingelser). Detta innebär att totalantalet rastande gäss underskattas och att medeluppehållstiden överskattas (därav benämningen maximal medeluppehållstid). Om vi antar att LOS i genomsnitt överskattas med 20%, så blir totalantalet taigasädgäss som rastade i Umeälvens delta under studieperioden i medeltal 3075 per år.

Brånsjön är belägen ca 35 km väster om Umeälvens delta och är den näst viktigaste rastlokalen för taigasädgäss i södra Västerbotten. Trots dessa lokalers närhet till varandra finns inga observationer som tyder på ett betydande dagligt utbyte av gäss. I Figur 3 jämförs dagsräkningar 2003–2008 och i Tabell 2 anges dagsmaxium för de båda lokalerna för perioden 2005–2008 (de år med bäst täckning av alla lokaler i Väster- och Norrbotten). Det framgår av Figur 3 att den tidsberoende variationen i rastantal i stort samvarierar för de båda lokalerna under studieperioden. Avflyttningen sker synkront, men en skillnad är att den första vågen av taiga-

sädgäss från söder nästan uteslutande använder sig av de tidigare snöfria slätterna vid Umeälvens delta. Detta resulterar i att kulminationen infaller i medeltal några dagar senare i Brånsjön. Detta var speciellt tydligt 2006 och 2008 då ett stort snödjup i början av rastperioden omöjliggjorde födosök vid Brånsjön.

En intressant notering är att den maximala summan av antalet taigasädgäss som rastar i Umedeltat och Brånsjön under samma dag visar en ganska liten variation vårarna 2005–2008 (Tabell 2). Notabel är våren 2006, då endast 534 taigasädgäss noterades som mest i Brånsjön men desto fler (2320) sågs i Umedeltat. Detta indikerar att taigasädgäss som ”normala” vårar i första hand väljer Brånsjön som rastlokal nyttjar Umeälvens delta om snön hindrar näringssök på inlandslokalen. Det avvikande höga rastantalet i södra Västerbotten 2008 (3700 ex 21 april) kan dessutom förklaras med att taigasädgäss som normalt sträcker direkt till rastlokaler i norra Västerbotten (Ostträsket) och Norrbotten (Alvik/Ersnäs) tvingades stanna längre än normalt i Umeälvens delta på grund av stora snödjup längre norrut.

Den likartade dynamiken av rastantal i Brånsjön och Umedeltat, avsaknad av tecken på dagligt utbyte mellan loklaerna samt skillnad i sträckriktning vid vidareflyttning från dessa båda lokaler, fick Skyllberg m.fl. (2008) att framlägga hypotsesen att taigasädgäss som rastar i Brånsjön avviker från kusten med syfte att nå häckningsområden längre söder och västerut än taigasädgäss som rastar i Umeälvens delta. Endast märkning av enskilda individer kan fullt ut testa den hypotesen.

I Figur 4 redovisas och jämförs kulminationen på rastlokaler längs den västra flyttvägen i södra Västerbotten (summan av antalen i Umeälvens delta och Brånsjön) och längs den central flyttvägen (summan av antalen rastande i Kristinestad och Kauhajoki). Som framgår av figuren så infaller kulminationen 8–15 dagar tidigare i västra Finland. Skillnaden i kulmination är mindre sena vårar (2006), som visar ett mycket koncentrerat rastförlopp, än tidiga vårar (2007 och 2008), som ofta visar ett mycket utdraget förlopp med flera flyttningsvågor. Vi kan konstatera att sträcket längs den västra flyttvägen från södra Sverige till norrlandskusten vanligen inte kommer igång i betydande omfattning förrän rastantalen kulminerat och taigasädgässen börjat lämnat sina rastplatser i västra Finland. Det betyder också att vi bör söka ursprunget till den västra flyttvägens taigasädgäss bland de rastplatser i södra och mellersta Sverige som fortfarande hyser betydande mängder sädgäss vid denna tidpunkt.

Den 15 april 2007 hade rastningen av taigasädgäss vid Kristinestad och Kauhajoki kulminerat sedan mer än en vecka (Figur 4) och sträcket längs den västra flyttvägen just påbörjats. Antalet taigasädgäss ökade från 565 (14 april) till 1370 (16 april) vid Brånsjön och från 1020 (14 april) till 1443 (15 april) i Umeälvens delta (Figur 3). Vid Alirs Öga, Söderhamn, räknades 835 nordsträckande taigasädgäss, under tiden 08:00–14:00 med en kulmination mellan kl. 10:00 och 12:30. Fem timmar senare kulminerade inträcket vid Umeälvens delta där 471 taigasädgäss räknades mellan kl. 14:00 och 20:00 (Figur 5). Sträcket iakttogs även från Hörnefors vattentorn där ungefär hälften av taigasädgässen avvek från kusten och sträckte vidare mot Brånsjön (jämför Figur 1). Det skall poängteras att de finns mycket få rastlokaler i det dominerande skogslandskapet mellan Söderhamn och södra Västerbotten, varför antalet taigasädgäss som gått ner och rastat längs denna sträcka kan antas vara litet. Flyghastigheten beräknades till 68 km h^{-1} mellan Söderhamn och Umeälvens delta. Med tanke på likartade väderbetingelser (måttliga sydvästvindar), så kan vi anta att gässen hade samma hastighet även söder om Söderhamn. Kulminationen vid Söderhamn motsvarar en tid för uppbrott mellan 04:20 och 06:50 vid Östen. Vid Kvismaren, som är en annan möjlighet, motsvarar kulminationen ett uppbrott mellan kl. 05:50 och 08:20. Med utgångspunkt att gässen vanligen bryter upp i gryningen (samma tidpunkt då de normalt flyger ut till födosöksfälten), ligger Östen bäst till som möjlig uppbrottsplats. Östen och Kvismaren är två rastlokaler som såväl 2007, som andra år, hyser tillräckligt många taigasädgäss i mitten av april för att kunna matcha den numerär som ses längs den västra flyttvägen.

För att kunna göra en beräkning av det totala antalet taigasädgäss som nyttjar den västra flyttvägen krävs även räkningar från rastlokaler i norra Västerbotten (Ostträsket) samt Norrbotten (Alvik/Ersnäs samt Persöfjärden). Även om räkningarna på dessa lokaler varit mer oregelbundna, så ger stapeldiagrammen i Figur 6 en översiktlig bild av det tidsmässiga rastförloppet i relation till Umeälvens delta. Som framgår av figuren rastar betydande mängder sädgäss på de båda nordliga rastplatserna (Persöfjärden, som saknas i diagrammet, nyttjas i varierande grad mellan år och kulminationen sker vanligen senare än Alvik/Ersnäs) redan under kulminationen vid Umeälvens delta. Samtidig nedgång vid Umeälvens delta och uppgång på lokalerna längre norrut (framförallt vid Alvik/Ersnäs) indikerar dessutom att en del

gäss gör två stopp under våren, vilket bekräftas av pågående färgringmärkningsstudier (Leif Nilsson, pers. comm.).

En rak summering av samtliga viktiga rastlokaler i Väster- och Norrbotten under en och samma dag under kulminationen på de sydliga rastplatserna (observera att en linjär interpolering varit nödvändig på lokaler som inte räknades varje dag) visar att mellan 4000 och 4800 taigasädgäss rastade under vårarna 2005–2008 (Tabell 2). Eftersom denna summa inte beaktar omsättning och ankomst av nya gäss, framför allt till de nordliga rastplatserna i slutet av säsongen, så kan vi slå fast att minst 5000 sädgäss nyttjar den västra flyttvägen. Med tanke på att nya vågor av anländande sädgäss flera gånger har noterats passera Umeälvens delta (utan att rasta) i månadskiftet april–maj, sannolikt för att fylla på rastplatserna längre norrut, så är vår bedömning att ytterligare minst 1000 taigasädgäss, kanske betydligt fler, bör adderas till den totala skattningen. Denna siffra innefattar även hundratalet taigasädgäss som rastar på mindre rastplatser i Ångermanland.

Under senare år har det uppmärksammats att de sädgäss som rastar/häckar i Nordnorge, och som enligt ringmärkningsåterfynd dessförinnan rastar i Norrbottens kustland, domineras av tundrasädgäss *Anser fabalis rossicus*. Enlig Øien & Aarvak (2008) rör det som om totalt 500–1000 ruggande tundrasädgäss (och ett okänt antal taigasädgäss). Många av gässen har inte helt typiska rossicus-karaktärer och är därför inte lätta att bestämma till underart. Detta innebär att det finns en osäkerhet i den populationsskattning om 5000–6000 individer taigasädgäss längs den västra flyttvägen som vi nyligen gjorde baserat på 2002–2006 års räkningar (Skyllberg m.fl. 2008). Med 2007 och 2008 års räkningar som grund, som pekar på en något större population än tidigare, samt beaktande möjligheten att 500–1000 av de sädgäss som rastar i framförallt Norrbotten är av underarten rossicus, så bedömer vi ändå att 5000–6000 taigasädgäss är en rimlig skattning. Om det skulle visa sig att i storleksordningen 1000 tundrasädgäss nyttjar den västra flyttvägen, så är den nedre gränsen (5000) ett rimligt estimat av antalet taigasädgäss.